Development Services

Electrical Plan Review Submittal Guide

Introduction

This guide outlines the information and documents required for electrical plan review submittal. It will help you assemble an accurate and complete set of electrical plans for your proposed design. This submittal guide includes:

- The City of Bellevue's criteria for electrical plan review, along with RCW, WAC and Washington Cities Electrical Code requirements for electrical plan review.
- An electrical plan review checklist. This is the form that will be used by the electrical plans examiner when performing the electrical plan review.
- A list of equipment required to be on the emergency or legally required systems.
- Smoke control guidelines
- Examples of typical items included in electrical plans

Our goal is to provide you with the quickest turnaround time possible. Providing complete submittal information will help to achieve this goal.

All applicants for a City of Bellevue electrical permit are required to complete an electrical permit application. Please provide a specific description of the work to be completed.

Although your electrical plans will be checked for compliance with many sections of the National Electrical Code, the focus of our review will be the load on the electrical system and life-safety issues. Your review will begin at the individual branch circuit and will investigate all equipment and conductors in the load path back to the service point.

Forms

The fault current calculation form must be completed and submitted prior to plan review approval. The following forms are available for use in your submittal or you may create your own forms, provided they are in accordance with our requirements.

- Sample One-Line Diagram (attached)
- Sample Panel Schedules (single-phase and 3-phase)
- Generator Load Summary Calculation form
- Residential Small-Scale PV System Standard Electrical Diagram, Notes and Site Plan (attached)
- Micro-Inverter Electrical Diagram

Requirements for Electrical Plan Review

Submit electrical plans for the following installations:

- Multifamily (three units and larger).
- All work on electrical systems operating at over 600 volts.
- All educational, institutional and health or personal care occupancies classified or defined in WAC 296- 46B-010(14).
- All commercial generator or UPS installations.
- All wind, solar or fuel cell installations for commercial or residential occupancies.
- All work in areas determined to be a hazardous (classified) location by the NEC.
- Existing tenant alterations 2,500 square feet and greater, where the load is increased by 100 amperes or greater, or the service is altered. This will include sub panels, transformers, UPS systems and generators.
- Other installations under 2,500 square feet where there is a significant increase in load (100 amps or more) or the service is altered.
- If 50% or more of lighting fixtures change, contact the electrical plan reviewer.
- Temporary Services 400 amps and larger 120/208 volts.
- Temporary Services – 277/480 volts

Design, signature and stamp requirements by a registered electrical engineer are required for the following electrical installations:

- All services or feeders rated 1600 amperes or larger or any special considerations to the service.
- Installations that require engineering supervision by the NEC.
- All educational facilities, hospitals and nursing homes, per the requirements of City of Bellevue ordinance 23.05.105.
- As required by the building official for installations which, by their nature, are complex or hazardous or pose unique design problems.

Electrical Plan Review Checklist

The intent of this checklist is to provide a general guideline for electrical plan review. This checklist may not include all items to be verified for every plan review encountered. This checklist may include more items than a specific set of electrical plans encompasses. Please tailor this checklist for the electrical plans submitted and the scope of your job.

Submittal Items (for paper submissions, submit two (2) copies)

- ☐ Electrical plans showing power and lighting for each floor and the location of all panelboards.
- ☐ Electrical plans showing the location of all controlled receptacles for each floor (where required).
- ☐ Electrical plans that are stamped and bear the signature of a State of Washington registered electrical engineer (where required).
- ☐ Electrical panel schedules showing individual loads in VA or KVA and the A.I.C. rating.
- ☐ A riser or one-line diagram with wire and raceway size, type and grounding methods.
- ☐ Electrical load calculations, including a load summary showing connected loads and all demand/diversity factors.
- ☐ Fault current calculations through the sub-panelboard level.
- ☐ Lighting budget calculations per the 2015 Washington State Energy Code.
- ☐ Selective coordination information for emergency, legally required and elevator systems.
- ☐ Arc flash hazard calculations, where required (see Arc Flash Calculations).
- ☐ PV system one-line and module description sheet.

Electrical Load Calculations

- ☐ Breakdown of connected loads into proper NEC categories (lighting, receptacles, motors, HVAC, kitchen equipment, appliances, etc.).
- ☐ NEC demand factors applied to each category of load.
- ☐ Total connected load in VA or KVA.
- ☐ Total calculated load in amps and KVA.
- ☐ Panel schedule worksheet completed for all panelboards.
- ☐ Starting loads for the worst case (max. starting loads with everything starting that is required to start at the same time) and any starting variables (soft start, variable frequency drives, etc.) for the emergency, legally required and optional standby systems.

Fault Current Calculations on the Riser Diagram

- ☐ Submit on the City of Bellevue Fault Current Calculations form with enough information on the riser diagram to verify the calculations.
- ☐ Submit a Fault Current Summary for very large projects (page 3 of the Fault Current Calculations form).

  A Fault Current Summary must include the following:

  - ☐ The starting nodes for fault current in a cascading format as they relate to the one-line diagram.
  - ☐ The starting fault current at the beginning of each conductor.
  - ☐ The ending fault current at the ending of the conductor.
  - ☐ The conductor's impedance, size and length.
  - ☐ The date when the study was performed
  - ☐ The conduit type (metallic or non-metallic)
  - ☐ The A.I.C. rating of the service, panelboards and overcurrent devices.

- ☐ Include utility transformer size in KVA, impedance (%Z), and available fault current.
- ☐ Complete fault current information through the subpanel board level or provide calculations to below the minimum AIC rating of the electrical equipment and overcurrent devices.
- ☐ Show available fault current on the one-line diagram for all nodes.
- ☐ Series rated systems - Circuit breaker model numbers for every panel or switchboard involving a series rated system are indicated on the one-line or the panel schedules. Please provide corresponding series rating charts from the manufacturer (with arrows indicating the breaker types) so the series rated system can be verified. This information should be provided in a systematic way as it relates to the one-line diagram, down to the point in the system that the fault current is less than the fully rated or series rated overcurrent protective device and gear.

Riser Diagram (one-line)

- ☐ Clearly identify the service point.
- ☐ Identify voltages and number of phases.
- ☐ Identify the service conduit(s) size and type, number of parallel runs, conductor(s) size and type, insulation type and number of conductors.

- ☐ Indicate the service equipment ampacity, A.I.C. rating and the A.I.C. ratings of the overcurrent protection.
- ☐ Indicate points (nodes) at line and load points along the one-line diagram. The nodes should state the AIC levels at key points of terminations of electrical equipment.
- ☐ Indicate the ground fault protection of equipment when required.
- ☐ Indicate the size of the grounded service conductor for the maximum unbalanced load.
- ☐ Identify the grounding electrode system, including concrete encased electrode, the sizing of the grounding electrode conductor and main bonding jumper for the service equipment.
- ☐ Identify the feeder conduit(s) size and type, conductor size and type and number of conductors.
- ☐ Type of equipment grounding conductor and equipment bonding jumper for feeder(s), size if applicable.
- ☐ Panelboard(s) ampacity, A.I.C. rating and overcurrent protection.
- ☐ Transformer(s) secondary tap conductor length to overcurrent protective device.
- ☐ Grounding electrode system and grounding electrode conductor for transformer(s).
- ☐ Size of equipment bonding jumper and system bonding jumper for the transformer(s).
- ☐ Overcurrent protection of transformer(s) complies with NEC 450-3 and overcurrent protection of secondary taps per 240.21.
- ☐ Identify all fuse types (class type).

Floor Plan (Lighting)

- ☐ Indicate the type and location of all lighting fixtures on the electrical plans.
- ☐ Indicate all required switch locations on the electrical plans.
- ☐ Home-run conduit(s) show the size, type and number of conductors.
- ☐ Branch circuit(s) are properly sized for the load.
- ☐ Clearly note emergency lighting on plans.
- ☐ Unit equipment used for egress lighting complies with NEC 700-12(e).

Energy Code Compliance

- ☐ Electrical plans correspond to the lighting summary; including number and wattage of the lighting fixtures, type of lighting fixture, the occupancy type and the watts per square foot allowed specifically based on the building area. Use the space by space method or the building area method.
- ☐ Lighting control complies with the 2015 Washington State Energy Code, chapter C405.
- ☐ Complete a lighting summary form.

Floor Plan (Power)

- ☐ Indicate the location of all switchboards, panelboards and transformers on plans.
- ☐ All electrical equipment has working clearance shown, as required by NEC Article 110.
- ☐ Receptacle outlet locations. Receptacles required by local amendments, for rooftops, show windows, etc., and as required by NEC 210.52 and Bellevue City Codes and Ordinances.
- ☐ Submit an electrical equipment schedule with the electrical plans.
- ☐ Indicate locations for all motors, compressors, heaters, stationary appliances, etc., on electrical plans.
- ☐ Branch circuit(s) are properly sized for the load.
- ☐ Transformers over 112.5 KVA require 1 hour rated construction surrounding them.
- ☐ Diagram of any transformer vaults including drain pipes, curbing, venting and fire ratings.

Panel Schedules

- ☐ Panelboard(s) are identified by naming convention and consistent throughout the plans.
- ☐ Show panelboard busbar rating in amps.
- ☐ Show panelboard voltage rating.
- ☐ Show main breaker size or main lug only.
- ☐ Note double lugs or feed-through lugs on the panel schedule.
- ☐ Provide a description or coding for each branch circuit (motors, lighting, general-use receptacles, etc.).
- ☐ Show the connected load of each branch circuit is in VA or KVA.
- ☐ Show the total connected load in VA or KVA.

- ☐ Demand load totals with each branch circuit are denoted with a designator as to what kind of load it is (lighting, motor, general-use receptacle, specific-use receptacle, etc.).
- ☐ Note the A.I.C. rating of the panelboard and overcurrent devices.
- ☐ Time/current curves showing compliance with the selective coordination requirements for elevators and escalators, emergency, legally required systems, and essential electrical systems in health care facilities are included.
  - ☐ Provided for both the normal power and emergency/legally required standby sides of the automatic transfer switch(es).
  - ☐ For elevators and escalators, this shall be shown to the next common overcurrent device (common to more than one driving machine) above the elevator overcurrent device to the level of .01-time line, for emergency and legally required systems to the .01 timeline and for essential electrical systems in health care facilities to beyond the .1 timeline.
- ☐ Indicate Arc flash hazard calculations where required.

Emergency, Legally Required Standby or Optional Standby Systems

Refer to the Legally Required Emergency Power Systems and Legally Required Standby charts.

- ☐ Indicate generator capacity and voltage, including starting and running capacity.
- ☐ Indicate UPS capacity and voltage.
- ☐ System is properly sized for the load.
- ☐ Indicate that the room housing the emergency generating system has a 2-hour fire rating (NFPA 20) and the emergency system is totally separate from all other systems.
- ☐ Individual transfer switches are required.
- ☐ The grounding electrode conductor is properly sized (when required for separately derived systems). State the number of poles in the transfer switch.
- ☐ Note signage as required by NEC.
- ☐ Selective coordination of overcurrent protective devices for emergency and legally required systems down to the .01 timeline – overlaid time/current curves for each branch from each power source to each branch circuit overcurrent protective device on one sheet.
  - ☐ 2-hour protection of the pressurization fan circuit(s) from the emergency generator to the fan is provided.
- ☐ Provide separation of the pressurization circuits from other electrical system components.

- ☐ On a high-rise building with electrical fire pumps - calculate into the generator load calculation and service load calculation if fed through the service.
- ☐ Provide 2-hour protection for feeders from emergency generator to fire service elevators.

Peak Demand Records (NEC 220.87 or WCEC 220.87(1) exception)

- ☐ Show starting and ending dates of the metering.
- ☐ Clearly show the highest reading of the metering period.
- ☐ Show calculation per 220.87.
- ☐ Show the power factor adjustment, when necessary.
- ☐ Explain the details of seasonal and occupancy adjustment factors.
- ☐ Include utility demand records or recordings of demand metering for the peak period with submittal.
- ☐ Include the signature of the administrator or engineer who took the readings.

Healthcare Facilities

- ☐ Clearly define the area use (dental, medical, chiropractic, etc.)
- ☐ Indicate the ceiling height as it pertains to a patient care area.
- ☐ Clearly define the rooms uses (patient room, nurses' station, critical care, general care, etc.).
- ☐ One-line showing separate transfer switches for equipment, life safety and critical branches.
- ☐ Show ground fault protection where required and at the next level as required.
- ☐ Show wiring methods in patient care areas.
- ☐ Selective coordination of overcurrent protective devices for the emergency and essential electrical system and sub-feeds (where required)

Hazardous Locations

- ☐ Clearly define the of area use and where the classified location starts and stops.
- ☐ Show the wiring methods (type of conduit).
- ☐ Identify the location of sealing fittings, where required (class 1, div.1, etc.).
- ☐ Indicate the depth of buried conduit.
- ☐ Diagram of sump pump showing motors, drain pipes and all chambers.

Smoke Control Systems

High rises, places of assembly of 1,000 or more persons and other building types, where required

- ☐ Panel schedule (industry standard type) for the emergency panel with connected and demand loads.
- ☐ Provide a schedule of smoke control components showing the equipment, the load in amps or volt-amps, the conduit type and size, conductor type and size, and breaker type and size.
- ☐ Provide floor plans showing the location of the smoke control components.
- ☐ Show all emergency system wiring methods pertaining to the smoke control.
- ☐ Provide a schedule of individual smoke control components running loads.
- ☐ Show the total combined loads of smoke control components for start-up and run (start-up and run shown separately).
- ☐ Identify the color marking, protection and routing of the conduit from the generator to the pressurization fan(s).

Arc Flash Hazard Calculation

- ☐ Provide**:** (1) the incident energy level calculation in cal/cm squared at 18" from the flash hazard; (2) the flash hazard category; (3) the flash hazard boundary for each service, distribution board and panel; and (4) the date the arc flash calculation was done. Provide this in a cascading format relating to the one-line or riser showing:
  - the device rating and identification
  - the voltage
  - the arc duration
  - the bolted fault current or the available fault current

  The nomenclature used must match the one-line diagram for panel/ distribution identification. Refer to Washington Cities Electrical Code 110.16. Equipment labeling shall be per the requirements in 2018 NFPA 70E, 130.5(H).

  Verification of the calculation will not be required where it is stamped and signed by an electrical engineer currently licensed in the State of Washington.

  No flash hazard analysis is required where all the following conditions exist:
  - The circuit is rated 240 volts or less
  - The circuit is supplied by one transformer
  - The transformer supplying the circuit is rated less than 125 kva

- ☐ Provide the arc flash values stated above on the one-line for each service, distribution board and panel.

Electric Vehicle Charging Systems

- ☐ Provide the level of the supply equipment.
- ☐ Provide a site or floor plan with location of the system including physical protection specifics, if required.
- ☐ Conduit and conductor sizes to the outlets or equipment.
- ☐ Show ratings of the equipment.
- ☐ Panel schedule with demand and connected load.

Photovoltaic Systems – NEC and WAC 51-54A-0605

- ☐ One-line diagram of the system showing conduit and conductor sizes, connection to the existing service, overcurrent size(s) (see examples below)
- ☐ Grounding electrode conductor sizes and location of connection(s) to the system
- ☐ Physical location of the inverter
- ☐ Plan view of the array layout on the roof (clearly showing setbacks from the roof edge and peak)
- ☐ Spec sheet showing the power ratings, etc.
- ☐ Penetration location of the conductors into the house or attic.
- ☐ Derating calculation of the conductors on the roof and/or in the attic.
- ☐ Panels/modules installed on residential buildings with roof hips and valleys shall be located no closer than 18” (457mm) to a hip or valley where panels/modules are to be placed on both sides of a hip or valley.
- ☐ Panels/modules installed on residential buildings shall be located no higher than 18” (457mm) below the ridge.
- ☐ Location of DC conductors on residences. Conduit, wiring systems, and raceways for PV circuits shall be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between sub arrays and to DC combiner boxes shall be installed in a manner that minimizes the total amount of conduit on the roof. DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays.

☐ Panel schedule(s) showing loads in demand and connected KVA.

☐ Show method of the connection per NEC article 705.12.

Revisions made after Plans approval

☐ Provide revision symbols (clouds or other effective means) around changes with something to indicate the date it was changed. These need to stay on the plans throughout the project.

☐ Provide descriptions of specific changes that are proposed in the revised areas

☐ Full sets of electrical plans are required for all revisions

Temporary Services (see above categories for specifics on each item below)

☐ One-line diagram of the system

☐ Load calculations

☐ Panel schedule(s)

☐ Fault current calculations

☐ Arc flash hazard calculations (where required)

Legally Required Emergency Power Systems

Type of Equipment	Maximum Time to Energize Loads	Minimum Run Time (Duration)	IBC Section	IFC or NFPA Section
Exit signs	10 seconds	2 hours	1013.6.3	604.2.9 High rises 604.2.16 Underground buildings 1013.2.13 Temporary tents, canopies, membrane structures NFPA 70
Exit illumination	10 seconds	2 hours for generator power; or 90 minutes for battery backup	1008.3	1008.3 604.2.9 High rises 604.2.16 Underground buildings

Type of Equipment	Maximum Time to Energize Loads	Minimum Run Time (Duration)	IBC Section	IFC or NFPA Section
Any emergency voice/alarm communication including area of refuge communication systems (barrier-free and horizontal exits)	NFPA 72	24 hours (battery) 4 hours (generator)	402.7.3, 402.7.4, and 907.5.2.2 Covered mall buildings 403.4.8 and 907.5.2.2 High rises 405.8 and 9.7.5.2.2 Underground buildings 907.2.1 and 907.5.2.2 Assembly occupancies	907.2.20 Covered mall buildings 604.2.9 High rises 604.2.16 Underground buildings 907.2.1.1 Assembly occupancies
Fire detection and fire alarms	NFPA 72	24 hours (battery) 4 hours (generator)	403.4.8 High rises 405.8 Underground buildings 909.20.6.2 Smokeproof enclosures 907	604.2.9 High rises 604.2.16 Underground buildings 907.6.2 NFPA 72
Smoke control systems in high-rise buildings, underground buildings and covered mall buildings including energy management systems are used for smoke control or smoke removal	60 seconds	2 hours	403.4.8 High rises 404.7 Atriums 405.8 Underground buildings 909.11 Smoke Control	909.11

Type of Equipment	Maximum Time to Energize Loads	Minimum Run Time (Duration)	IBC Section	IFC or NFPA Section
Fire pumps in high-rise buildings and underground buildings	10 seconds	8 hours (NFPA 20)	403.4.8 High rises 405.8 Underground buildings	604.2.9 High rises and NFPA 20 604.2.16 Underground buildings 913.2 All fire pumps
Smokeproof enclosures and elevator shaft pressurization	60 seconds for pressurization	4 hours	403.4.8 High rises 909 and909.20.6.2	
Any shaft exhaust fans required to run continuously in lieu of dampers	60 seconds	4 hours	717.5.3	
Fire service or occupant evacuation elevator car operation in high rise and underground buildings (including control system, motor controller, operation control, signal equipment, machine room cooling/heating, etc.)	60 seconds	4 hours	3003, 3007 and 3008	604.2.9 High rises 604.2.16 Underground buildings
Elevator car lighting and communications in high-rise and underground buildings	10 seconds	4 hours	3003, 3007 and 3008	604.2.9 High rises 604.2.16 Underground buildings 604.2.1 Elevators
Lights, heating, and cooling for building fire command center and mechanical equipment rooms serving the fire command center	60 seconds	24 hours		604.2.9 High rises
Power (other than lights, heating and cooling) for building fire command center	60 seconds	4 hours		

Type of Equipment	Maximum Time to Energize Loads	Minimum Run Time (Duration)	IBC Section	IFC or NFPA Section
Mechanical and electrical systems required by IFC 27 (hazardous materials including UPS rooms)	60 seconds	4 hours		Chapter 27

Legally Required Standby

Type of Equipment	Maximum Time to Energize Loads	Minimum Run Time (Duration)	IBC Section	IFC or NFPA Section
Exhaust fans for any loading dock located interior to a building	60 seconds	4 hours		
Transformer vault ventilation equipment	60 seconds	4 hours		
Heat tape for sprinkler lines and heating in sprinkler riser rooms	60 seconds	4 hours		
Fuel pump system for any legally required system	60 seconds	4 hours		
Elevators in high rise or underground buildings used for accessible means of egress	60 seconds	2 hours		
Any shaft exhaust fans required to run continuously in lieu of dampers	60 seconds	4 hours	717.5.3	

Reminders and Notes

- The seismic bracing calculations and diagrams by engineering standards submitted to the building reviewer for equipment between 75 lbs. and 400 lbs. at 4' or more above the floor or roof level, or equipment more than 400 pounds at ground level or any height.
- NEC 110.16 and NFPA 70E field marked warning labels to warn workers (qualified) of the potential electric flash hazards.
- Washington Cities Electrical Code 110.16 A plate or label is required and shall include the flash hazard category, the incident energy level in cal/cm(squared) at 18 inches from the flash hazard, and the flash hazard boundary and the date the arc flash calculations were done.
- Bellevue Fire Department requires the circuit and control wiring going to the stairway and elevator shaft pressurization fans be separate and protected from all other systems in the building. They are required to be protected by a 2-hour rated assembly. They shall be separated from the emergency system from the transfer switch (if specific to the pressurization fans) or the first distribution point after the transfer switch to the fans.
- Revisions to the original approved plans need to be clouded and dated indicating when the change took place. The revisions need to be accompanied by a narrative explaining each change.

If you have comments, questions or concerns about the City of Bellevue's electrical plan review program, please contact:

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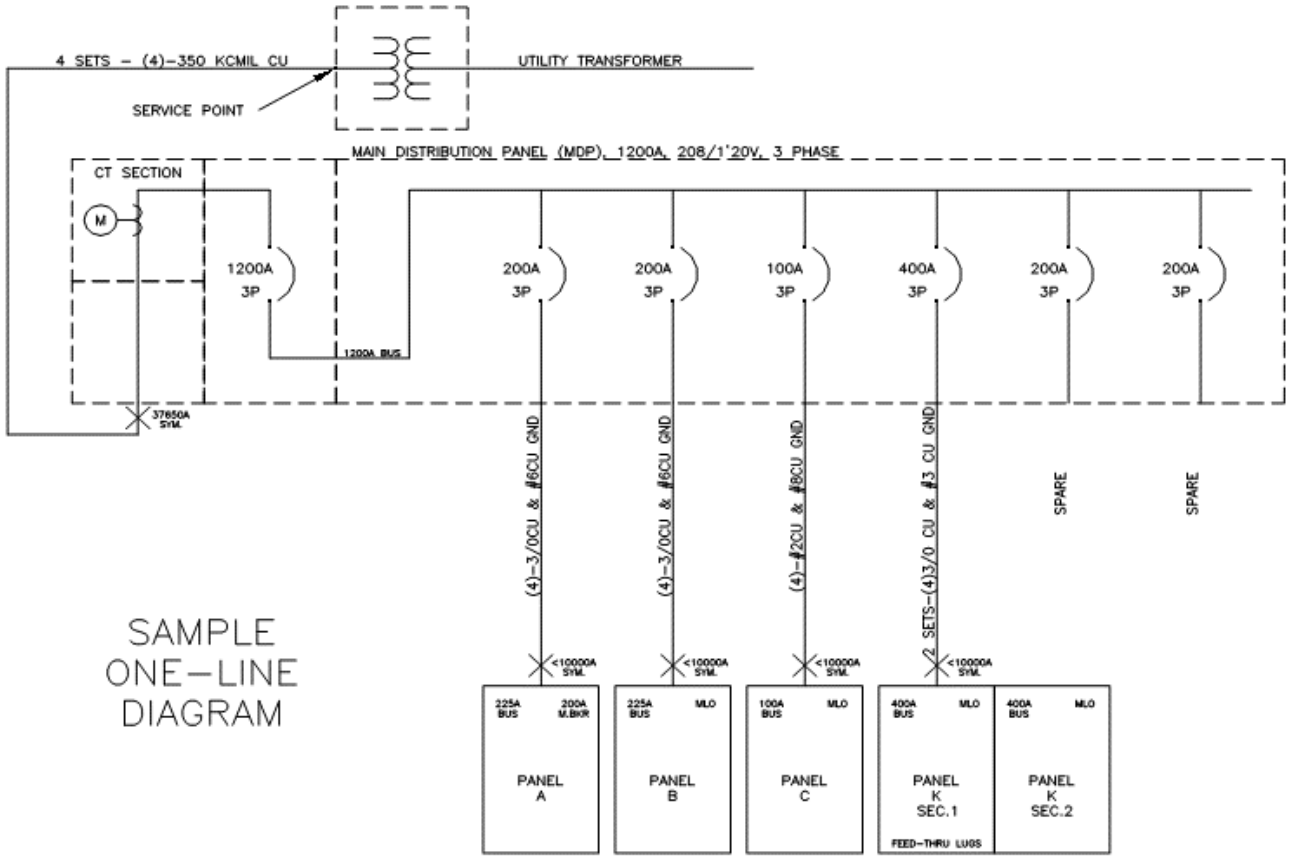
Sample One-Line Diagram

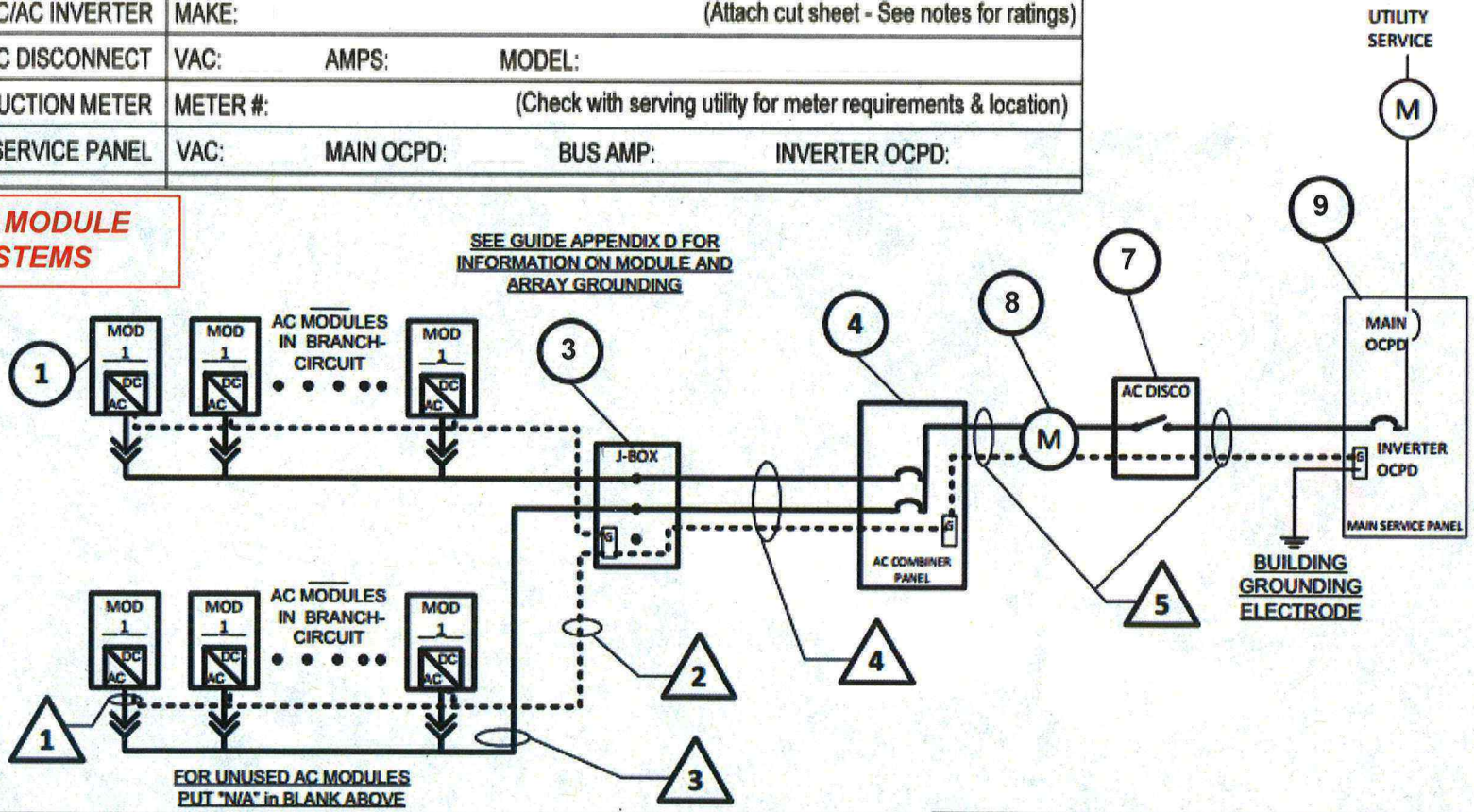


SAMPLE ONE–LINE DIAGRAM

TAG	EQUIPMENT SCHEDULE				
1	SOLAR PV MODULE	MAKE:	MODEL:		(Attach Cut Sheet - See notes for ratings)
2	PV ARRAY	WEIGHT:	HEIGHT FROM ROOF:		(Attach cut sheet of mounting system)
3	J-BOX	LENGTH:	WIDTH:	HEIGHT:	NEMA RATING:
4	COMBINER	MAKE:	MODEL:		(Attach cut sheet)
5	DC DISCONNECT	VDC:	DC AMP:	MAKE:	
6	DC/AC INVERTER	MAKE:			(Attach cut sheet - See notes for ratings)
7	AC DISCONNECT	VAC:	AMPS:	MODEL:	
8	PRODUCTION METER	METER #:			(Check with serving utility for meter requirements & location)
9	SERVICE PANEL	VAC:	MAIN OCPD:	BUS AMP:	INVERTER OCPD:

Contractor - Installer Information	
Permit #:	Date:
Name:	
Address:	
Contact Name:	
Contact Phone:	
Email:	

ACPV MODULE SYSTEMS



TAG	Conductor Insulation Type	CU/AL	Conductors			*Derated Amps	Raceway		Ambient Temp		Distance off Roof	
			Size	Amps	Num		Size	Type	Roof	Attic		
1												
2												
3												
4												

Standard Electrical Diagram - Residential Small Scale PV System
ACPV MODULE SYSTEMS

THIS PLAN MUST BE PROVIDED TO THE INSPECTOR AT THE JOB SITE

Site Name:

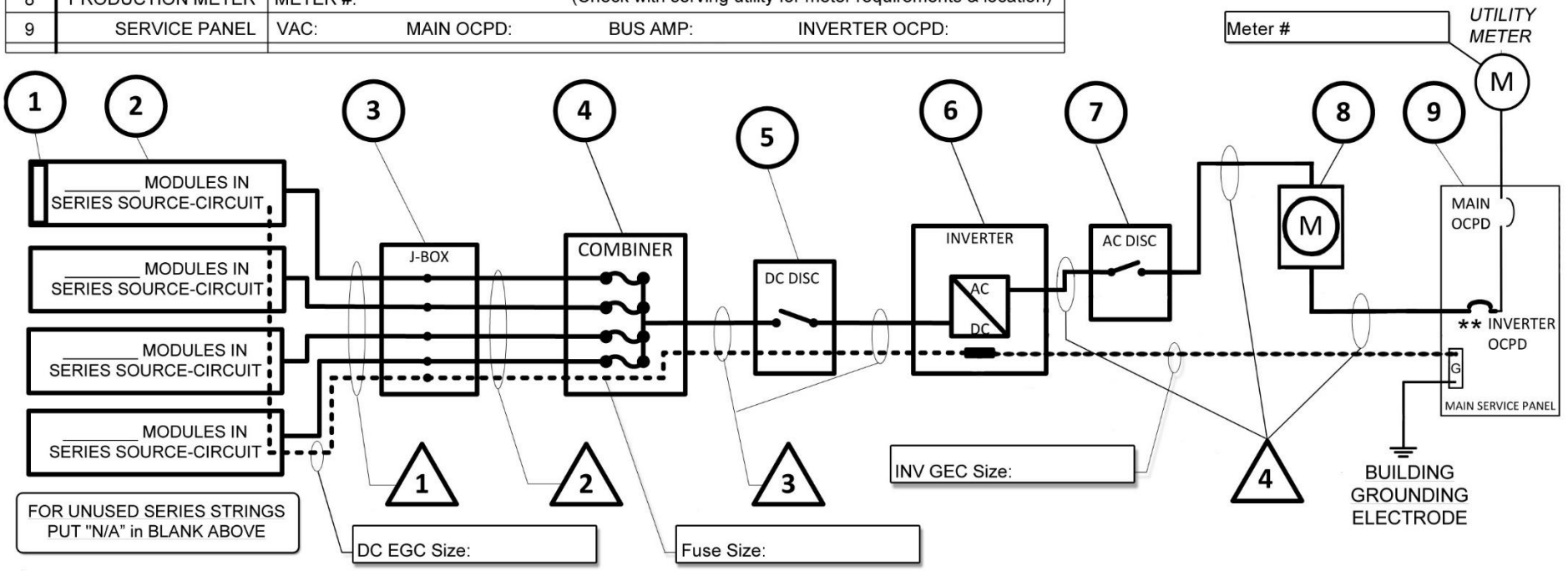
Site Address:

This plan is NOT intended to be used with micro inverters or transformer-less inverters. Conductors, where installed outdoors in raceways shall be "W" rated and have an insulation rating of 90 deg C.

Rev - 02/21/2013

TAG	EQUIPMENT SCHEDULE				
1	SOLAR PV MODULE	MAKE:	MODEL:		(Attach Cut Sheet - See notes for ratings)
2	PV ARRAY	WEIGHT:	HEIGHT FROM ROOF:		(Attach cut sheet of mounting system)
3	J-BOX	LENGTH:	WIDTH:	HEIGHT:	NEMA RATING:
4	COMBINER	MAKE:	MODEL:		(Attach cut sheet)
5	DC DISCONNECT	VDC:	DC AMP:	MAKE:	
6	DC/AC INVERTER	MAKE:			(Attach cut sheet - See notes for ratings)
7	AC DISCONNECT	VAC:	AMPS:	MODEL:	
8	PRODUCTION METER	METER #:			(Check with serving utility for meter requirements & location)
9	SERVICE PANEL	VAC:	MAIN OCPD:	BUS AMP:	INVERTER OCPD:

Contractor - Installer Information	
Permit #:	*Date:*
Name:	
Address:	
Contact Name:	
Contact Phone:	
Email:	



TAG	Conductor Insulation Type	CU/AL	Conductors			*Derated Amps	Raceway		Ambient Temp		Distance off Roof	
			Size	Amps	Num		Size	Type	Roof	Attic		
1												
2												
3												
4												

*Note: Derating of conductors based on number of conductors in raceway, ambient temp and distance off roof where applicable. (NEC 310.15)
**Note: Conductors and overcurrent devices shall be sized to carry not less than 125 percent of the maximum currents. (NEC 690.8(B))

Standard Electrical Diagram - Residential Small Scale PV System
Central Inverter Systems

THIS PLAN MUST BE PROVIDED TO THE INSPECTOR AT THE JOB SITE

Site Name:

Site Address:

This plan is NOT intended to be used with micro inverters or transformer-less inverters. Conductors, where installed outdoors in raceways shall be "W" rated and have an insulation rating of 90 deg C.

Rev - 02/21/2013

NOTES for Residential Small Scale PV System Electrical Diagram	
Permit #:	Date:
Contractor:	
Job Address:	
Contact Name:	
Contact Phone:	

SIGNS

SIGN FOR DC DISCONNECT

PHOTOVOLTAIC POWER SOURCE	
RATED MPP CURRENT	A
RATED MPP VOLTAGE	V
MAX SYSTEM VOLTAGE	V
MAX CIRCUIT CURRENT	A
WARNING: ELECTRICAL SHOCK HAZARD–LINE AND LOAD MAY BE ENERGIZED IN OPEN POSITION	

SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)

SOLAR PV SYSTEM AC POINT OF CONNECTION	
AC OUTPUT CURRENT	A
NOMINAL AC VOLTAGE	V
THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)	

PV MODULE RATINGS

MODULE MAKE	
MODULE MODEL	
MAX POWER-POINT CURRENT (I_{MP})	A
MAX POWER-POINT VOLTAGE (V_{MP})	V
OPEN-CIRCUIT VOLTAGE (V_{OC})	V
SHORT-CIRCUIT CURRENT (I_{SC})	A
MAX SERIES FUSE (OCPD)	A
MAXIMUM POWER (P_{MAX})	W
MAX VOLTAGE (TYP 600V_{DC})	V
VOC TEMP COEFF (mV/°C☐ or %/°C☐)	
IF COEFF SUPPLIED, CIRCLE UNITS	

INVERTER RATINGS

INVERTER MAKE	
INVERTER MODEL	
MAX DC VOLT RATING	V
MAX POWER @ 40°C	W
NOMINAL AC VOLTAGE	V
MAX AC CURRENT	A
MAX OCPD RATING	A

LOWEST EXPECTED AMBIENT TEMP:	°C
HIGHEST CONTINUOUS TEMPERATURE:	°C

NEC 690.8(B) Photovoltaic system currents shall be considered continuous.

NEC 690.8(B)(1) The circuit conductors and overcurrent devices shall be sized to carry not less than125 percent of the maximum currents calculated in 690.8(A).

Exception: Circuits containing an assembly, together with its overcurrent device(s), that is listed for continuous operation at 100 percent of its rating shall be permitted to be utilized at 100 percent of its rating.

All signage and markings shall be a phenolic or metalic plate or other similar material in block letters 1/4 inch or greater in height, and suitable for the environment. Letters and background shall be in contrasting colors. Screws, rivets or other approved means shall be used to affix plates to equipment.

INVERTER		PANELBOARD	
Maximum Current	OCPD Size	Main Bus	Main OCPD
56 amps	70 amps	225 amps	200 amps
36 amps	45 amps	225 amps	225 amps
33 amps	40 amps	200 amps	200 amps
24 amps	30 amps	150 amps	150 amps
20 amps	25 amps	125 amps	125 amps
16 amps	20 amps	100 amps	100 amps

SITE PLAN RESIDENTIAL SMALL SCALE PV SYSTEM		Provide roof outline with location of all PV panels, j-box, combiner and DC disconnect.	
Permit #:	Date:	Contractor:	Contrator Phone:
Job Address:		Contact Name:	Contact Phone: